January 17, 1967

Biological Evaluation of a Tent Caterpillar (Malacosoma sp.) Outbreak in Zion National Park, 1966

The following is an evaluation of a tent caterpillar (Malacosoma sp.) outbreak on Fremont poplar in Zion National Park in 1966. Background material for this report was compiled from special evaluation surveys undertaken during the spring and fall; from laboratory investigations including rearing and feeding tests, and by visual observation of the infestation.

Briefly, heavy tent caterpillar populations continued their relentless defoliation of Fremont poplar in Southern Utah. In Zion National Park, control work was undertaken by mistblower application of a microbial insecticide. Control effectiveness varied, but some tree protection was obtained. This effort, together with a series of biological factors including parasitism and possibly a disease, caused a general population decline in the Park and possibly elsewhere. A special egg mass survey indicates light to negligible defoliation in 1967. No control will be needed. A detailed discussion of this problem follows:

Heavy tent caterpillar populations continued to defoliate Fremont poplar in portions of Southern Utah again this year. The known limits of the infestation extend from Beaver Dam, Arizona, along the Virgin River, into Zion National Park. Heaviest defoliation occurred in and near the communities of Rockville and Springdale and in Zion National Park.

During the first week of March 1966, egg mass samples were taken from several infested trees within the Park to determine the preferred oviposition sites of this insect preliminary to the development of a workable sampling technique and to provide a rough estimate as to the expected population level and subsequent defoliation. From this survey, it was determined: (1) that over 99 percent of the egg masses are laid within 21 inches of the branch tips; consequently, a 25-inch branch is a valid sample unit; (2) the percent of nonhatch; (3) the extent and kind of parasitism; and (4) that Fremont poplar, the host tree would, most likely, receive moderate to heavy defoliation. This defoliation estimate was based on the evaluation system developed for the Great Basin tent caterpillar on aspen by the Forest Insect Laboratory in Albuquerque. This prediction table is as follows:

Average No. new egg masses per two 30-inch branches (Aspen)	Predicted defoliation
0.1 to 0.7	Light
1.2 to 1.7	Moderate
2.5 or more	Heavy

The above prediction table was developed for another insect species and a different host tree, but lacking more applicable data, it was used for comparative purposes on a trial basis. There is reason to believe that a similar table for the tent caterpillar on Fremont poplar would not deviate markedly from the above. The average number of egg masses on two 30-inch Fremont poplar branches taken throughout the infestation this spring ranged from none to 6.8 with an average of 2.6. There is little doubt that heavy to extreme defoliation would have resulted in some areas without the Bacillus thuringiensis (thuricide 90 TS) control effort. In most areas not treated by the mistblower, heavy defoliation did result. Some trees were completely stripped of foliage, while others were only moderately defoliated. Heavy defoliation also occurred occasionally in the treated area, and some trees were defoliated in spite of repeated mistblower applications. The reasons for this are not fully understood, and there may be several factors involved, but the single most important factor is believed to have been the extremely high population level. Tent caterpillars were so numerous in some trees that even though a high percentage of control was obtained, there were a sufficient number of survivors to continue destructive feeding. Other factors that might have caused the variable control results were spray dilution, variance in rate of application, and viability of the 90 TS concentrate. Any or all of these factors may have had some effect on the final outcome. At the start of the project, the mistblower was underproducing and lesser dosages may not have been as effective as heavier concentrations applied after larger nozzles were used. Finally, the viability of the 90 TS concentrate was somewhat uncertain. Last year spore counts averaged 26×10^9. Spore counts made from the same lot this year averaged only 15.3×10^9, well below that of last year and also much lower than claimed by the manufacturer (30×10^9). What effect a lower spore count might have, however, is open to question because indoor and outdoor feeding tests conducted this spring against this insect showed this same lot of 90 TS to be highly effective.

From egg mass data collected this fall, it seems likely that Fremont poplar in Zion National Park will have a much needed respite from tent caterpillar damage in 1967. Ten 25-inch branches (5 from mid-crown and 5 from the upper crown) were taken from 15 trees in the Park within the 1966 infestation boundaries. An additional 5 mid-crown branches were taken from 5 trees in the vicinity of Zion Lodge, north of the present infestation, in an attempt to detect any northward population movement. Egg masses were collected, brought into the laboratory, counted and examined for unusual predation and parasitism.

The number of new, viable egg masses found was very low. Both predation and parasitism were exceptionally high. On the 150 25-inch branches collected from 15 trees, a total of 72 new egg masses were found. Of this number, 55 egg masses, or 76 percent of the total, were completely destroyed by unknown predators. This left only 17

intact viable egg masses for the 150 branch samples, or 0.11 egg masses per branch, or 0.22 egg masses per two-branch sample. According to the prediction table, only light to negligible defoliation will result from this size population.

The reasons for the low egg population are unknown. It is possible the application of Bacillus thuringiensis resulted in some control, but moth flight from within and without the sprayed areas would make it impossible to ascertain the amount due to the bacterial spray. Diseased tent caterpillar larvae found on Fremont poplar near St. George were mailed to the Division of Invertebrate Pathology, Agriculture Experiment Station, Berkeley, California, and there the diseased specimens were diagnosed as having a nuclear polyhedrosis virus. The same disease may be present in the Park infestation. Normally once a gregarious insect like this tent caterpillar develops a highly transmissive virus, it spreads rapidly throughout the population, and this may be the case in Zion.

An examination of partially disected egg masses showed that parasitism of the remaining egg masses is also apparently quite high. This tent caterpillar overwinters in the egg as first instar larvae. By rearing egg masses, the degree of emergence, amount, and kind of parasitism can be more accurately determined.

Evidence of nonemergence and parasitism by undetermined Dipterons and Hymenopterous wasps of tent caterpillar pupae was plentiful. There appeared to be considerably fewer pupae in the field this year compared to last year. Predation and parasitism of larvae were not observed. Evidently there was some mortality from starvation, particularly in those trees that were completely defoliated.

William H. Klein

WILLIAM H. KLEIN, Entomologist